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Impacts of Draft 2012 International Fire Code on Residential Solar PV Installations in Washington State

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Summary: The 2012 draft International Fire Code (IFC) includes many provisions applicable to solar photovoltaic (PV) systems. Solar professionals and advocates in Washington State are particularly concerned with the impacts of the access and ventilation provisions on of the IFC on single-family residential solar PV installations. Approximately 2,000 grid-intertied solar PV systems currently exist in Washington State, nearly all of them located on single family residential homes. The draft IFC originated in southern California and its assumptions may not be consistent with local conditions and fire fighting practices. The draft IFC is also complex and local jurisdictions will be burdened with interpreting its application on a case by case basis to each homeowner. Because solar modules typically go only on one roof surface, leaving one or more roofs open, a solar array should not impact fire department access to the building.

Question: Considering the potential impacts to solar PV, are the code provisions the most appropriate? Does the draft IFC create more problems than it solves?

Issue 1: Application of ventilation standards and roof access provisions on small residential roofs. Most solar photovoltaic (PV) systems in Washington State are installed on residential rooftops. An unshaded south facing roof is the best location for a solar array. However east and west facing roofs are also sometimes utilized when there is no south facing roof or when additional roof area is needed for the size of solar array desired. A north roof will never be used for a flush mounted solar array.

A typical residential roof may contain skylights, gables, chimneys, and vents that reduce the available area for solar equipment. Shading from nearby trees commonly reduces the area available for solar modules.

Application of the access and ventilation standards of the draft 2012 International Fire Code (IFC) will significantly reduce the solar area of most roofs and prohibit solar equipment on some small home roofs. Less restrictive code language would still ensure firefighter access to all residential roofs without impacting the solar area available to the homeowner.

In the example below a 2 kW array on a Port Angeles garage with studio above would be eliminated by the draft code provisions. Section 605.11.3 would require a 3 foot access and pathways on each side of the south facing roof (see black lines for these areas). Section 605.11.3 of the draft IFC would also require a 3 ft. ventilation setback from the peak. The result is that this building could not have a solar array.

What are the alternatives for access and ventilation? The studio above the garage has a vaulted ceiling that could be vented through the skylights on the south side or from the north side of the roof. Also, ventilation could occur by opening the windows. This situation is typical of small residential structures.

Example 1.

Port Angeles home and detached garage/studio, owned by a veterinarian. Both the home and the studio have solar arrays. Total power about 4 kW.

In the example below, an older home has a complex roof with gables, hips, valley's, and even a flat section (on top next to chimney). Many roofs do not fall into the neat categories created by the draft IFC section 605.11. The provisions in the draft IFC regarding hips and valleys is especially unclear. Section 605.11.3.2.1 requires a 3 foot wide clear path on all roof slopes where modules are located. That would eliminate this small array pictured in the south roof below.

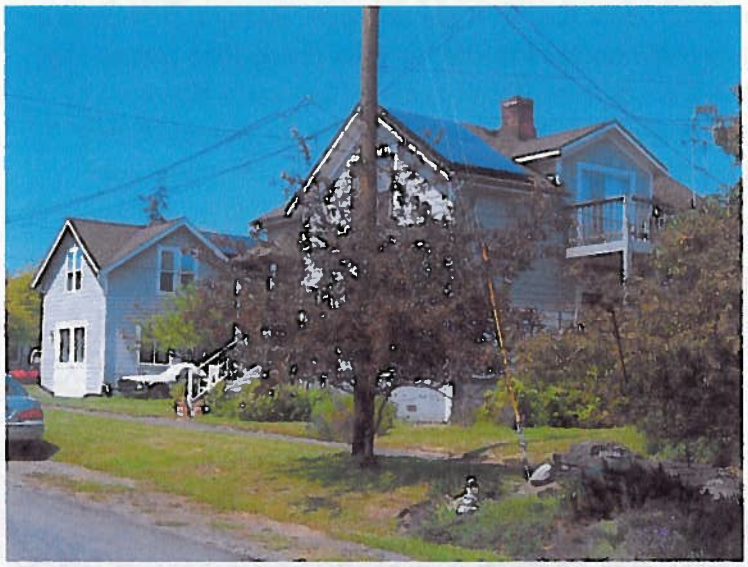
However, section 605.11.3.2.3 states that modules shall be located no closer than 18" to a hip or valley if modules will be on the other side of hip or valley but may be right up to hip or valley if no modules will be on the other side. Which code section applies? The local jurisdiction would have to decide.

The draft IFC presumes that solar modules block access and prevent roof ventilation. In the vast majority of cases, a solar array will cover only a small portion of a roof. In nearly every situation there is access to the roof and an area for ventilation not covered by the solar PV array. Requiring access and ventilation requirements through setbacks should only be necessary where most of the roof on both sides of a ridge is covered by solar modules.

The photos below show a home and detached shop/studio with three solar arrays. It is unclear how the draft IFC would be applied to these structures and what the impacts to the solar area would be. However, it is clear there is plenty of room on this home for accessing the roof and ventilating in the unlikely event that it was ever necessary.

Example 2: Home and detached shop/studio have small solar PV arrays on three roofs while leaving ample area for roof access for firefighters.

These photos show the difficulty of classifying the type of roof and the setbacks.



Example 2 continued: The draft code could eliminate or significantly reduce all the above pictured arrays depending upon interpretation.

Port Townsend home and shop owned by a boat builder.

Example 3: Draft fire code changes would eliminate 14 of 23 modules on this roof.

Result: 56% reduction in solar array due to proposed setbacks.

Port Angeles home. Retired Army Captain.

The home shown below has three solar arrays. The two upper arrays are over an attic and the lower array over a covered porch.

Example 4: This roof has valleys over an attic and a covered porch. Depending upon the interpretation, the draft IFC could eliminate all three of these solar arrays.

Bremerton home. Owners are an artist and a teacher.

Sometimes a homeowner wants to cover the whole roof with solar modules. The opposite side of the roof typically is open, as in this case shown below.

Example 5: Some solar homeowners literally use the entire south roof for a solar array. Applying setbacks and a roof ventilation area would reduce this solar array by more than 50%. And in this case, the north side of the roof is completely accessible.

Port Townsend home. This home is a rental.

Issue 2: Draft IFC access, pathway, and ventilation rules work better for large roofs. The photos below show a number of solar installations on larger roofs with little or no shading and few obstacles to mounting solar equipment. However, these types of structures and situations are not the norm in the northwest. Small lots and multistory homes with small, cut up roofs are common here. In southern California, where the solar provisions originated, ranch style homes with large roofs are more common.

Example 6: This large barn/shop has been fitted with a 9 kW solar array. The setbacks and ventilation provisions would increase the cost of installing this system, but would not have reduced the system size. The north side of the roof is fully accessible for firefighters.

Sequim shop. Owner has a catering business.

While these residential structures have large roofs and could accommodate the access and ventilation provisions, it is not clear that they are necessary. All of these roofs are accessible from the north side of the structure and can be ventilated at the top of each ridgeline. The home below on the left is just outside Port Angeles and the home below on the right is outside of Sequim.

Example 7: Serenity house is a homeless apartment building located in Port Angeles. It is Perhaps the first in such facility in the US with a solar array. The draft rules would have required relocation of about 8 solar modules. Because the roof is large, this would not have resulted in a reduction of the overall size of the array.

However, on a roof this big, are the setbacks necessary?

Issue 3: Ventilation setback from peak and ice or snow damming. Snow is not common in southern California, but it does snow in the northwest. Normally a solar array is mounted even with the peak of a home and snow melts or slides off easily. The ventilation provisions of the IFC require that the solar array be no closer than 3 feet from the peak unless the authority having jurisdiction (AHJ) determines other ventilation measures are feasible. In areas of regular or heavy snow, this 3 foot gap above the solar modules could result in snow or ice damming eventually resulting in roof damage or leaks.

Normally snow melts quickly and slides off a solar array after 1 or 2 sunny days. The snow will melt from the solar array before the rest of the roof.

Example 7: Snow remains on solar modules as long as the weather is cold and cloudy. The person on the left isn't waiting for the snow to melt.

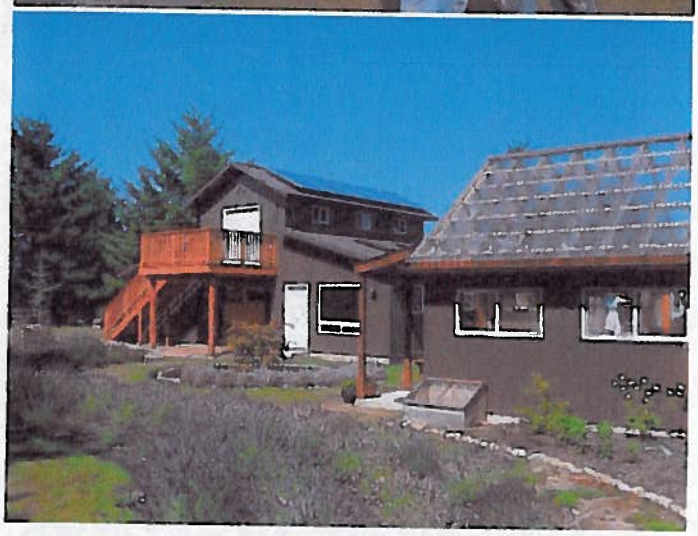
Photo from web.

Example 8: On the first sunny day (even if cold) snow will melt and slide off solar modules quickly.

Port Townsend home. Retired couple.

Issue 4: Is there ever a time when solar modules will cover a roof?

While uncommon, yes, is is possible to have a residential shed roof completely covered with solar modules, or a roof with an east and west exposure filled with solar modules. If it is imperative to ensure firefighter access to a roof and ventilation, this should be the situation that should be addressed.



Example 9: The shop/guest house on the left is the only home in our 260 installations where we have covered both side of a roof with solar modules.

Is this situation hazardous? The ceiling is vaulted and there are multiple windows and doors for ventilation. Would a firefighter ever need to go on the roof?

Sequim home. Retired couple.

Conclusion

The proposed draft fire code rules would significantly impact the available roof space for residential solar systems. Interpreting the setbacks and access provisions will be burdensome for staff. Alternative access and ventilation areas are typically available on residences with solar equipment so long as both roofs (east and west) are not covered with solar equipment. If less than 50% of the roof area is covered with solar equipment, a single family residence should be exempt from the access and ventilation provisions. Where more than 50% of the roof area on both sides of the ridge will be covered with solar equipment, then the access and ventilation provisions should apply. Where the AHJ determines there to be other provisions for ventilation and no need for roof access, the setback standards should be able to be waived by the AHJ.